Massachusetts Year 2002 Integrated List of Waters

Part 1 - Context and Rationale for Assessing and Reporting the Quality of Massachusetts Surface Waters

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INTRODUCTION

The Federal Water Pollution Control Act of 1972 (FWPCA) and subsequent Amendments in 1977, 1981 and 1987 are collectively known as the Clean Water Act (CWA). The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. As one step toward meeting this goal the CWA requires states to develop information on the quality of their water resources and report this information to the U.S. Environmental Protection Agency (EPA), the U.S. Congress, and the public. Each state must establish a program to monitor and assess the quality of its surface and groundwater and report on its findings. The § 305(b) Summary of Water Quality Report, submitted to the EPA every two years and supplemented by annual electronic updates, is the primary reporting mechanism used by the states for this purpose. EPA compiles the individual state reports into a national report to Congress on the status of water quality nationwide.

The 305(b) Report presents the status of water resources with respect to their capacity to support designated uses as defined in each of the states' surface water quality standards. These uses include aquatic life support, fish and shellfish consumption, drinking water supply, and primary (e.g., swimming) and secondary (e.g., boating) contact-recreation. The 305(b) process entails assessing each of these uses for rivers, lakes and coastal waters. Where possible, causes and sources of use impairment are also identified.

It is not enough, however, to simply describe the status of water quality if polluted waters are to be restored and protected from problems in the future. Section 303(d) of the CWA and the implementing regulations at 40 CFR 130.7 require states to identify those waterbodies that are not expected to meet surface water quality standards after the implementation of technology-based controls and to prioritize and schedule each of them for the development of a total maximum daily load (TMDL). A TMDL establishes the maximum amount of a pollutant that may be introduced into a waterbody and still ensure attainment and maintenance of water quality standards. Furthermore, a TMDL must also allocate that acceptable pollutant load among all potential sources. The sum total of all pollutant load allocations, including those for point and nonpoint pollution sources as well as an allowance for natural background loads and a margin of safety, cannot exceed the total maximum allowable pollutant load calculated for the receiving water.

This document (Part 1) presents the methodology used for assessing waters in Massachusetts for the purpose of reporting on their status in the 305(b) Report and listing impaired waters in accordance with § 303(d). A brief description of the Massachusetts water quality monitoring, assessment and management program is followed by a more detailed description of how water resource data and related information are used to assess the level to which waters are supporting their designated uses. In addition, the assumptions and procedures that guide the preparation of the Massachusetts 303(d) "List of Impaired Waters" are provided, resulting in a complete description of two of the reporting elements under the Clean Water Act. The 2002 version of these reporting elements, combined into a single integrated list of Massachusetts waters, is presented in Part 2. It presents the status of individual waterbodies based on their most recent assessments and represents the combined report to the EPA under sections 305(b) and 303(d) for 2002.

BACKGROUND - THE CLEAN WATER ACT

Two overarching approaches to enhancing and maintaining the integrity of the Nation's waters are reflected in the provisions of the CWA. One approach focuses on the application of technology-based standards, while the second is based on regulating pollutant discharges in consideration of their effects on receiving water quality. Amendments to the Act over the years have placed greater or lesser emphasis on one or the other strategy while retaining elements of both. The Water Quality Act of 1965 first required federally-approved standards for interstate waters and by the late 1960's most states had adopted minimum standards for a wide variety of uses. The adoption of these standards alone, however, did not prove effective in ameliorating water quality. What was missing

was a framework for directly linking the water quality standards to mandatory pollution control activities. While the statute did call for the development of plans for implementing and enforcing the standards, little guidance was offered on what these plans should entail. Therefore, implementation plans were rarely produced and progress toward abating pollution remained largely a matter of informal negotiation between state officials and the wastewater dischargers.

With passage of the 1972 FWPCA, the rather ineffective water quality-based program described above gave way to a focus on wastewater treatment performance standards. Although this legislation was the first to introduce the goal of achieving water quality, which would provide for "the protection and propagation of fish, shellfish, and wildlife" and "recreation in and on the water" (so-called "fishable/swimmable"), the FWPCA emphasized the adoption and implementation of national effluent standards. Throughout the 1970's effluent limitations based primarily on treatment technology were included in National Pollutant Discharge Elimination System (NPDES) wastewater discharge permits. Moreover, this Act provided for the appropriation of large sums of money to pay for the construction of sewage collection and treatment infrastructure. This led to broad-brush implementation of secondary treatment at most publicly-owned treatment works (POTWs) and the application of categorical (e.g., "best available treatment" or BAT) requirements to industrial wastewater discharges. These measures were very successful in substantially reducing pollutant loadings to the Nation's surface waters. Nonetheless, many of those waters were still not "fishable" or "swimmable".

Subsequent revisions to the CWA redirected water quality management programs back toward water quality-based planning and permitting. Inherent in this approach was the strengthening of State's ambient water quality standards programs. Increased concern in the 1980's for toxic contamination led to the derivation of ambient water quality criteria for pollutants, such as heavy metals and synthetic organic chemicals that are harmful to fish and other aquatic organisms. These criteria represented scientific assessments of the effects on human health and aquatic life of pollutants present in water but by themselves were non-regulatory. When these or alternative criteria were adopted in state water quality standards, however, they became enforceable numbers not to be exceeded in receiving waters. Section 304(l) of the Water Quality Act of 1987 required states to identify waters affected by toxics and incorporate into wastewater discharge permits individual control strategies (ICS) for reducing toxic pollutant loadings to acceptable levels.

While progress toward cleaning up the Nation's waters was certainly realized through the implementation of the various programs described above, states continued to report in their 305(b) reports that many waters were not meeting their intended uses. During the 1990's several lawsuits were brought against the EPA for failure to require the states to submit lists of impaired waters and calculate TMDLs in accordance with the requirements of § 303(d). As a result, TMDLs have become the mechanism for translating the goals embodied in the water quality standards into the measures that will achieve those goals.

In theory TMDLs represent a logical approach for achieving surface water quality goals and addressing waters where existing controls are inadequate to achieve water quality standards. However, the complexity of TMDLs varies considerably and while some can be derived through rather simple "desk-top" calculations, many require the use of sophisticated loading and receiving water predictive models that require substantial data for proper calibration and verification. Because the monitoring and modeling efforts required for the development of TMDLs can be very labor-intensive states have estimated that a large increase in funding and personnel will be needed if they are to complete TMDLs for all of their 303(d)-listed waters within a reasonable period of time. Moreover, the high costs predicted for TMDL programs nationwide over the next several years underscores the need for states to accurately assess their waters using credible scientific data so that only truly impaired waters are included on 303(d) lists and limited resources for TMDL development are allotted to those waters most in need of restoration.

MASSACHUSETTS SURFACE WATER QUALITY STANDARDS

The establishment of achievable goals for surface waters is fundamental to their restoration and protection. To this end, states adopt surface water quality standards that ascribe these goals in the form of beneficial uses that are assigned to specific defined waterbodies. For example, waters may be designated for the support of aquatic life, recreational use, and fish and shellfish consumption. The standards also specify criteria that waterbodies must meet in order to support their assigned uses. Criteria may be expressed as numerical values that should not be exceeded in ambient water, such as a mean coliform bacteria count of 200 colonies per 100 ml, or a minimum instream dissolved oxygen concentration of 5 mg/l. Alternatively, water quality standards may include narrative statements that waters shall be free from constituents in concentrations that would impair their intended uses.

Whether numerical or narrative in form, criteria must be closely related to the uses that they are intended to protect. The bacterial content of waters designated for recreational purposes, for example, must be specified at a level low enough to minimize the risk of water-borne diseases to humans who come into contact with those waters. Likewise, standards for metals or other potentially harmful constituents must be set at concentrations below levels that could be toxic to humans or other organisms living in or on the water.

As previously noted, the derivation of criteria that must be met to support various water uses is a scientific process aimed at determining safe or acceptable levels of water constituents. The establishment of goals in the form of use assignments to individual waterbodies, on the other hand, is a policy decision that must take into account the existing and pre-existing conditions of those waters, as well as the costs and benefits of achieving the uses. Thus, the adoption of water quality standards is a public process and the CWA specifies that states hold public hearings at least once every three years to review and, where appropriate, revise their surface water quality standards.

The Massachusetts Surface Water Quality Standards, found at 314 CMR 4.00, assign all inland and coastal and marine waters to classes according to the intended use of those waters. For example, Class A waters are designated as the source of public water supplies and, where compatible with this use, should also be suitable for supporting aquatic life and recreational uses such as swimming and boating. Class B waters are not water supplies, but are designated for all of the other uses cited above for Class A. Finally, Class C waters should be suitable for aquatic life and recreational uses where contact with the water is incidental, such as boating and fishing, but may not be suitable for swimming, diving, or water skiing. Similarly, Massachusetts' coastal and marine waters are assigned to classes that distinguish shellfish harvesting and recreational uses while providing suitable habitat for wildlife, fish and other aquatic life. In any case, minimum criteria are specified for each class based on the most sensitive use designated to that class. Additional criteria that apply to all surface waters are also included.

From this brief overview it should be evident that the process of assessing surface waters (305b) and listing impairments (303d) is inextricably linked to the Surface Water Quality Standards, as they define the uses that are to be evaluated for any given waterbody. In addition, the accompanying criteria provide the basis for determining whether or not the designated uses are, in fact, supported.

THE MASSACHUSETTS WATERSHED MANAGEMENT CYCLE

Massachusetts has adopted a watershed approach to planning and implementing water resource protection activities throughout the state. The quality of Massachusetts' surface waters is influenced not only by the natural ecology, hydrology, and geomorphology of the land area they drain, but also by the mosaic of land-use patterns resulting from man's activities within their respective drainage basins or watersheds. Thus, pollutants originating at remote locations in a watershed have the

capacity to adversely impact water quality for considerable distances downstream. For example, the deleterious effects of contaminants, such as pathogens, suspended solids or essential plant nutrients, that are released to surface waters within the watershed, either directly from wastewater treatment facilities (point sources) or as the result of being washed off the land with stormwater (nonpoint sources), may not be fully realized until they reach sensitive waterbodies, such as lakes, impoundments or estuaries. There they contribute to habitat alteration, the proliferation of algae and other aquatic vegetation, and other water quality problems. From this, it is readily apparent that effective water quality management of the waters in Massachusetts is largely dependent upon the prevention and control of pollution throughout their watersheds.

The notion of using the river basin or watershed as the basic planning unit in water quality management originated long before passage of the Clean Water Act. For example, during the years 1935-1941, the Massachusetts State Planning Board completed twenty-one basin studies that examined land and water use, stream pollution and other related issues, and made recommendations for managing multiple water uses in those basins. In the years that followed, several Massachusetts watersheds were the subject of comprehensive water supply or wastewater studies completed by various Federal agencies, such as the United States Army Corps of Engineers (COE) and the Federal Water Pollution Control Administration (FWPCA).

Section 303(e) of the Federal Water Pollution Control Act of 1972 (FWPCA) formally codified river basin planning for water pollution abatement. Between 1973 and 1975 the Massachusetts Division of Water Pollution Control (MDWPC) published 303(e) basin plans for over twenty watersheds and coastal drainage areas. These plans generally consisted of a summary of the surface water quality standards as they applied to the respective basins, a description of existing water quality conditions, a water pollution abatement strategy, including wasteload allocations for point sources where applicable, and a proposed future monitoring plan. All of the basin plans were approved by the EPA within one or two years of their completion. In addition to the 303(e) planning efforts, § 208 of the FWPCA established guidelines for the development of areawide waste treatment management plans for particular urban and industrialized areas that exhibited complex water quality problems. The major emphasis of the “208” planning effort was to be the control of local municipal and industrial wastewater, stormwater and urban runoff, combined sewer overflows (CSO), nonpoint sources of pollution, and water quality issues associated with various land-use types. Regional planning agencies were authorized to produce the 208 plans and between 1977 and 1979 approximately ten were completed. These plans were largely ineffective in controlling non-point pollution since they lacked regulatory authority and funding for implementation.

Throughout the 1980s it became increasingly evident that implementation of point source controls alone was inadequate to restore impaired waterbodies. While NPDES wastewater discharge permits provided the mechanism for accomplishing the recommendations contained in 303(e) basin plans, 208 area-wide waste treatment management plans that were intended to address stormwater and other non-point sources of pollution remained unused for lack of a regulatory framework to carry them out. The revitalization of watershed-based water resource management in the 1990s, therefore, was largely in response to the need to focus on a different strategy for nonpoint pollution control. The model that emerged emphasized outreach, education, and local voluntary action by people who live, work and recreate in the watersheds and, thereby, are most invested in their restoration and protection.

Today watershed protection has become the dominant theme of many State water quality management programs and the EPA has endorsed this approach by providing financial and technical support for its implementation. The approach allows for a comprehensive, integrated program that addresses all aspects of water resource management, such as drinking water protection and pollution abatement. Furthermore, the watershed approach expands the roles of government agencies, watershed associations and private citizens who all have an interest in restoring and protecting the integrity of water resources.

A phased program for watershed assessment and management was adopted by the Massachusetts Department of Environmental Protection (MADEP) in 1993. Twenty-seven major watersheds and coastal drainage areas in Massachusetts were placed on a rotating five-year schedule for monitoring, assessment, TMDL development, surface water permitting and non-point source pollution control. This approach was subsequently made the basis for a more collaborative water resource management program overseen by the Executive Office of Environmental Affairs (EOEA) that became known as the Massachusetts Watershed Initiative (MWI). Watershed teams, consisting of representatives from the EOEA agencies, federal agencies, watershed associations and other interested parties, were established to coordinate watershed planning and management activities in a more comprehensive and efficient manner.

During Year 1 of the rotating basin schedule all pertinent data and information relative to water resource management are gathered and reviewed to identify data gaps and the need for additional information. This process culminates in the development of a plan for obtaining this information during Year 2. At a minimum, a Quality Assurance Project Plan (QAPP) is formulated for all environmental monitoring activities to be performed. The scope of the monitoring efforts varies depending upon the resources available and the important water quality issues within each watershed. Input from outside agencies and the general public is actively solicited in order to gain further insight with respect to water quality goals and use-objectives for Massachusetts surface waters. Results of the monitoring efforts performed in Year 2, combined with all other reliable information, constitute the basis for making water quality assessments during Year 3 of the basin cycle. Assessments are made in accordance with the requirements set forth in § 305(b) of the CWA and are published in individual watershed water quality assessment reports. For purposes of reporting to the EPA, Massachusetts provides water quality assessments only for those watersheds that have completed the monitoring and assessment phases since the submittal of the previous 305(b) report. All assessments are stored in the Massachusetts Waterbody System (WBS), a database that maintains the results of the individual use assessments (i.e., aquatic life, recreational, etc.) as well as the overall use support status for each waterbody or segment.

Where applicable and feasible, the determination of site-specific water quality criteria, calculation of total maximum daily loads (TMDL), and the derivation of load/wasteload allocations may also be completed during Year 4 when possible. Wastewater and water withdrawal permits are also issued at this time. In addition, years 4 and 5 include the targeting of priority waterbodies exhibiting nonpoint pollution problems for the implementation of Best Management Practices (BMP) Grants, education and outreach to municipalities, or other control strategies.

The rotating watershed cycle allows for the synchronization of several water quality planning and management activities within the watersheds and focuses more efficiently the programs of various governmental and non-governmental organizations that are charged with restoring and protecting the water resources of Massachusetts.

WATER QUALITY MONITORING IN MASSACHUSETTS

Most surface water monitoring field operations and selected biological laboratory functions of the MADEP are performed by personnel of the Division of Watershed Management (DWM) with assistance from regional staff. The Division of Environmental Analysis provides analytical chemistry support at its laboratory, the Senator William X. Wall Experiment Station (WES). The goals of the DWM monitoring program are to provide data for the following purposes:

1. to assess whether the condition of the water resources of Massachusetts is of sufficient quality and quantity to support their multiple uses and to report findings in watershed assessment reports, the 305(b) Summary of Water Quality Report and the 303(d) List of Impaired Waters;

2. to identify, where possible, causes and sources of water use impairments as the first step toward developing water quality and quantity management strategies;

3. to characterize existing and emerging problems to target implementation strategies and funding from § 319 and other grant programs; and

4. to provide data for the development of appropriate simulation models in support of the calculation of TMDLs.

Like other watershed management program elements the DWM monitoring is also performed in accordance with the rotating five-year basin schedule. During the first year of the cycle, outreach activities and reconnaissance are performed to determine what information is available and what data will need to be obtained during the monitoring phase in "Year 2". Part of the outreach process involves gaining input from the EOEA watershed teams as to what water resource issues and problems are of most concern to them. The DWM formulates monitoring plans aimed at filling the information gaps that are identified. This has resulted in a targeted monitoring program that includes sites of known or suspected poor water quality. These sites tend to be of most concern to the public and are typically in most need of remedial action.

While attempting to respond to local, site-specific monitoring needs, the DWM also strives to obtain information of adequate spatial and temporal coverage to be used for making use assessments. However, each purpose for monitoring water quality encompasses a unique suite of analyses and associated methodologies, so no single monitoring program design purports to serve all possible reasons for monitoring. Therefore, the DWM is continually challenged to direct its finite monitoring resources at meeting the multiple monitoring goals listed above. The following discussion provides a brief overview of the existing monitoring program that supported the 2002 assessment and reporting cycle.

PHYSICAL/CHEMICAL MONITORING

River Water Quality Monitoring

Historically, river surveys were typically performed during low-flow, dry-weather conditions, which generally represented the worst-case scenario with respect to the assessment of impacts on receiving water quality from point discharges. Later, increased attention was given to the identification and control of nonpoint pollution, so survey methods changed to reflect this shift in emphasis. For example, wet-weather sampling may provide the most reliable information pertaining to nonpoint pollutant loadings from stormwater runoff and, when compared with dry-weather survey data, may further distinguish the effects of point and nonpoint pollution sources. Today, surveys are conducted on the watershed cycle to update old information, to support the development of TMDLs, and to examine the effectiveness of remedial actions, such as treatment facility improvements or implementation of Best Management Practices (BMPs) for controlling nonpoint sources of pollution.

Specific details pertaining to the monitoring efforts that supported the individual watershed assessments published to date can be found in each DWM watershed assessment report. However, these water quality surveys generally consisted of three sampling events for conventional water quality analyses such as pH, dissolved oxygen, suspended and total dissolved solids, nutrients, and fecal coliform bacteria. In some instances, additional sampling for bacteria was carried out in an attempt to identify potential sources of contamination.

River surveys are sometimes supplemented by wastewater discharge sampling, which serves to document pollutant loading from point sources to the river at the time of the survey and to assess compliance with NPDES discharge permit limits. In addition, stream discharge measurements may be made to supplement data from the United States Geological Survey (USGS) stream gages.

Discharge measurements provide data for the calculation of pollutant mass loadings, as well as for assessing the impacts on stream biota of low-flow conditions resulting from drought and/or water withdrawals. At times, additional site-specific data are collected for the development of water quality models. These data may include sediment oxygen demand, nutrient flux, and metal toxicity determinations.

Lake Monitoring

The MADEP's Lake Water Quality Monitoring Program was formally initiated in the summer of 1974 and was significantly expanded in its scope during most of the 1980s. Historically, limnological sampling was conducted to: a) determine baseline lake conditions, b) monitor post-implementation project effects, and c) respond to public concerns about lake problems. The focus of monitoring has changed over time and lake monitoring has been incorporated into the Watershed Approach. Lake monitoring is now conducted in the context of a review of issues within each basin. While the amount of overall lake monitoring is less than at the peak of the program the monitoring conducted is targeted in the highest priority areas.

Lake sampling by the DWM is now primarily limited to biological surveys of the macrophyton communities, "in-situ" measurements using metered probes, and limited water quality sampling to provide data for TMDL development and water use assessment. The surveys are generally conducted on multiple days for TMDL development and consist of bathymetric mapping; physical, chemical and biological sampling of the open water areas, tributary stream(s), and outlet; and a quantitative and qualitative mapping of the aquatic macrophyton community. The lake is sampled during the summer months when productivity is high.

Information from less intensive "synoptic" surveys is also reflected in the watershed assessments. These surveys have two primary goals. First, they provide information necessary to make a minimum assessment of lake quality. Second, they are used to document the spread of several non-native and potentially nuisance aquatic plant species that are known to be present in Massachusetts.

Coastal Monitoring

While the MADEP has performed some coastal monitoring in the past this is not currently a major component of the monitoring program. However, the MADEP relies on other Federal and State agencies, as well as local entities that maintain coastal monitoring programs. For example, the Division of Marine Fisheries (DMF) performs monitoring to support shellfish resource management decisions and to contribute to their periodic “Monograph Series” of marine resource assessments. In addition, the Massachusetts Water Resources Authority (MWRA) performs extensive monitoring to support outfall siting and Combined Sewer Overflow (CSO) management decisions, as well as to demonstrate the effectiveness of ongoing pollution control efforts. Finally, targeted research has been conducted through the National Estuaries Program to support the development and implementation of Comprehensive Conservation and Management Plans (CCMP). These include the Massachusetts Bays Program and the Buzzards Bay Program.

In 1996, the Massachusetts Office of Coastal Zone Management (MCZM) initiated a Marine Monitoring and Research Program (MMRP). Much of MCZM’s initial emphasis has been placed on gaining information necessary to implement BMPs for the improvement of the ecosystem health of coastal embayments.

In 2001 a collaborative effort known as the Massachusetts Estuaries Project was initiated by the MADEP and the School of Marine Science and Technology at the University of Massachusetts, Dartmouth (SMAST). The goals of this project, which will be implemented over six years, are to assess 89 embayments in southeastern Massachusetts and, where necessary, develop allowable nitrogen and bacterial loadings to those embayments.

BIOMONITORING

In-stream biomonitoring is an integral component of the watershed-based water quality management program. Its importance is underscored in the Clean Water Act that stresses the need to restore the biological integrity of the nation's waters and achieve water quality that provides for the protection and propagation of aquatic life. DWM biologists perform habitat assessments and conduct biological sampling to determine aquatic life use-support status, the fish consumption use, and to supplement other water quality monitoring and management programs.

Assessment of Aquatic Community Health

The DWM assesses the condition of resident macroinvertebrate, fish and algal populations in streams to provide a direct measure of the ecological response to cumulative effects of pollutant loadings and habitat degradation. Physico-chemical water data can provide a "snapshot" of conditions prevailing at the time of sampling. However, due to their temporal variability, solutes must be measured with some degree of replication in order to draw conclusions with respect to the overall quality of the water. Furthermore, surrogate chemical analytes are less reliable than the more direct biological assessment of instream "health". For example, although satisfactory dissolved oxygen values may provide the means for predicting that a given stream is supporting aquatic life, a survey of the organisms that spend all or a portion of their life-cycles in the water furnishes direct evidence that this use is or is not supported. Thus, the analysis of aquatic community structure and function indicates the general condition of the aquatic ecosystem, which, in turn, is dependent upon such factors as the quality of the habitat, water quality and flow regime.

Rapid bioassessment protocols (RBPs), based on those developed by the EPA, are used to monitor the health of benthic macroinvertebrate communities. These methods were developed to minimize laboratory time requirements for taxonomic identification and enumeration of benthos. Kick-net samples are collected at sites for upstream/downstream comparisons, for comparisons against a regional or surrogate reference, or for long-term trend monitoring. Two different levels of analysis are employed, RBP II or RBP III, depending on the objectives to be served.

Based on scoring of several metrics, three categories of impairment are discerned by the RBP II (nonimpaired, moderately impaired, and severely impaired), while the RBP III distinguishes between four (nonimpaired, slightly impaired, moderately impaired, severely impaired). Benthic macroinvertebrate RBPs are conducted at up to 75 sampling sites per year.

The analysis of the overall structure and function of the finfish community as a measure of biological integrity is also a component of the DWM water quality monitoring program. Fish bioassessment data quality and comparability are assured through the use of qualified fisheries professionals and the application of consistent methods. The DWM utilizes a standardized method based on the EPA Rapid Bioassessment Protocol V (RBP V) to improve data comparability among wadable sampling sites throughout the state.

The fish collection procedures employ a multi-habitat approach that allows for sampling of habitats in relative proportion to their local availability. A representative 100-meter stream reach is selected and delineated such that primary physical habitat characteristics of the stream are included (i.e., riffle, run, and pool habitats). Electrofishing has generally proven to be the most comprehensive and effective *single* method for collecting stream fishes, and is, therefore, the preferred method for obtaining a representative sample of the fish community at each sampling site. Fish (except young-of-the-year) collected within the study reach are identified to species (or subspecies), counted, and examined for external anomalies (i.e., deformities, eroded fins, lesions, and tumors). Aquatic life use-support status is derived from knowledge of the environmental requirements (i.e., water temperature and clarity, dissolved oxygen content, etc.) and relative tolerance to water pollution of the fish species collected. This information may also be used to corroborate findings of other community analyses or water quality testing.

Algae represent a third community that is sometimes assessed as part of the DWM biomonitoring efforts. The analysis of the attached algae or periphyton community in shallow streams or the phytoplankton in deeper rivers and lakes employs an indicator species approach whereby inferences on water quality conditions are drawn from an understanding of the environmental preferences and tolerances of the species present. Algal indicators of the presence of elevated metals concentrations, nutrient enrichment, or other pollutants are noted. Because the algal community typically exhibits dramatic temporal shifts in species composition throughout a single growing season, results from a single sampling event are generally not indicative of historical conditions. For this reason the information gained from the algal community assessment is more useful as a supplement to the assessments of other communities that serve to integrate conditions over a longer time period. In some instances, where information pertaining to primary production is required, algal biomass analysis or chlorophyll determinations may be performed. Results of these analyses are used to evaluate the trophic status of lakes, ponds, and impoundments. Similar information from riverine and coastal waters is used to identify those waterbodies subjected to excessive nutrient enrichment.

Finally, the aquatic macrophyte community is assessed, particularly in lakes and ponds, as part of the recreational use assessment of those waters. Cover estimates and species distribution are mapped and the dominant species as well as the presence of non-native species populations are noted.

Bioaccumulation Assessment

In addition to the community analyses described above, the DWM also collects some aquatic organisms to be assayed for the presence of toxic contaminants that may be sequestered in their tissues. The goal of this monitoring element is primarily to provide data for the assessment of the risk to human consumers associated with the consumption of freshwater finfish. In the past fish collection efforts were generally restricted to waterbodies where wastewater discharge data or previous water quality studies indicated potential toxic contamination problems. More recently concerns about mercury contamination from both local and far-field sources have led to a broader survey of waterbodies throughout Massachusetts. In both cases, the analyses have been restricted to edible fish fillets. This “Toxics-in-Fish” monitoring program is a cooperative effort of the MADEP, the Department of Fisheries, Wildlife, and Environmental Law Enforcement (DFWELE), and the Department of Public Health (DPH). Uniform protocols, designed to assure accuracy and prevent cross-contamination of samples, are followed for fish collection, processing and shipping. Fish are typically obtained with electrofishing gear or gill nets. Lengths and weights are measured and fish are visually examined for tumors, lesions, or other indications of disease. Data are provided to the DPH, which is the agency responsible for performing the risk assessments and issuing public health advisories.

The use of tissue bioassays to trace the fate and transport of toxic contaminants in the aquatic environment has been explored on a limited basis, as time and resources permit. Caddisfly and crayfish bioassays have been used to identify possible sources of polychlorinated biphenyls (PCB) in selected watersheds. However, the effects of potentially toxic chemicals on the organisms in which they accumulate are often not well understood. This renders tissue contaminant data of limited value for inferring aquatic life use support.

QUALITY MANAGEMENT PROGRAM

A system for assuring the reliability of scientific data and related information is an essential component of any environmental monitoring program and the MADEP is committed to ensuring that the monitoring data used to support the various water quality management activities specified in the CWA are of known and documented quality. This is achieved through the implementation of a Quality Management Plan for Federally Funded Programs that is revised every five years and submitted to the EPA for review and approval. This plan describes the policies and procedures used by the MADEP to make certain that all data and information collected in support

of programs to assess, protect and improve the environment are sufficient for their intended purpose.

The Quality Management Plan describes each element of the total quality system employed by the MADEP. Standard Operating Procedure (SOP) documents are prepared for all field and laboratory operations and are revised as needed to reflect changes in methodologies. All field and laboratory personnel receive periodic training in the execution of the SOPs. Individual Quality Assurance Project Plans (QAPPs) are prepared for each monitoring project. These may be prepared for a specific monitoring program element, such as benthic macroinvertebrate biomonitoring or fish toxics monitoring, or to cover all monitoring elements to be performed in a certain watershed and year (e.g., "2001 Monitoring Plan for the Taunton Watershed"). In either case, these plans clearly document in detail all aspects of the proposed monitoring program, including the goals and objectives of the monitoring to be carried out, the sampling design and logistics, data quality objectives (DQO) for precision and accuracy, equipment, personnel and training needs, quality assurance measures, and data management and reporting elements. The QAPPs are submitted to EPA for review and approval before the project work is initiated.

The DWM employs one full-time Quality Control Analyst who oversees the development of SOPs and QAPPs, coordinates staff training exercises, performs periodic field audits, and assists with data validation procedures. This staff member also serves as the liaison between the DWM, the analytical laboratory (WES), and EPA quality assurance personnel.

DATA MANAGEMENT

The DWM's *SOP for Data Validation and Usability* sets forth the steps currently taken to validate and verify environmental monitoring data. It provides guidance for accepting, qualifying, or rejecting data from a variety of sources. The DWM's data validation process includes the review of both field-recorded data and laboratory analytical data for conformance with the data quality objectives established in project-specific or programmatic QAPPs. These measures are implemented along with separate quality assurance and quality control activities performed at WES or any other analytical laboratory.

Results of the DWM data review process are documented in annual data validation reports that present the final recommendations with respect to the acceptability and suitability of the data for their intended purpose. Following this determination, data are entered with applicable qualifiers into electronic databases for storage and dissemination. The DWM currently maintains approximately a dozen electronic databases at various stages of development and use. Several of these are Access database structures designed to store environmental data generated by internal monitoring program elements, such as surface water quality, lake macrophytes, and benthic macroinvertebrates. Others are assessment databases or waterbody inventories that parse Massachusetts' rivers, lakes and coastal waterbodies into segments of manageable size for assessment and reporting convenience.

Information contained in the DWM databases is essential to the MADEP in order to meet key obligations to the EPA under the Clean Water Act as defined in the annual Performance Partnership Agreement (PPA) and to the EOEA under the Massachusetts Watershed Initiative. Such deliverables as watershed assessment reports, 305(b) reports, 303(d) lists, water quality maps, and TMDLs are generated from the monitoring, assessment and modeling activities performed by the DWM. These activities are, in turn, supported by the less visible, but critically important functions relating to data management, including QA/QC, database development and maintenance, and linking to Geographical Information Systems (GIS). The DWM continually receives requests to make their information and data available to the MADEP regional offices, the EPA, watershed teams and the general public. This is a key goal of ongoing database development and GIS program activities.

VOLUNTEER MONITORING PROGRAMS

Volunteer monitoring programs in Massachusetts vary considerably with respect to their missions and goals. While some groups organize rather sophisticated citizen monitoring programs with the goal of providing data to the DWM for assessment purposes, other groups employ a simpler approach to monitoring aimed primarily at increasing public awareness of environmental issues and building local support for watershed protection. At least one watershed association in Massachusetts maintains its own laboratory that is certified for selected water analytes. The DWM uses data from citizen monitoring groups and other external sources if they are of known and documented quality. This is ensured by requiring that external groups develop and adhere to, Quality Assurance Project Plans (QAPPs), use state-certified (or equivalent) laboratories, and submit citable reports that present survey methods, results and quality assurance information.

While citizen monitoring organizations do rely on the voluntary labor of their members for field sampling, these programs cannot be maintained without some level of financial support for the purchase of equipment and supplies and to obtain laboratory services. During the mid to late 1990's the EOEA Watershed Initiative responded to this need by providing monetary support for regional monitoring support centers at university laboratories, for example, and by administering a grant program to build the monitoring capacity of individual groups. A Citizen Advisory Committee oversaw the state-wide volunteer monitoring network from 1999 to 2001.

A COMPREHENSIVE MONITORING STRATEGY FOR THE FUTURE

A clear understanding of the existing quality of the surface waters in Massachusetts is a critical component of any program aimed at their restoration and protection. The CWA requires states to develop and maintain water monitoring programs to provide adequate data and information for determining the extent to which waters are meeting Water Quality Standards. When making these assessments states are encouraged to use data not only from their own monitoring programs, but to supplement their information with data from such organizations as other state and federal agencies, academic institutions and citizen monitoring groups. Nonetheless, the United States Government Accounting Office (GAO) recently concluded that the biennial National Water Quality Inventory reports do not accurately convey the status of the Nation's surface waters because only a small percentage of those waters are actually monitored and assessed. Furthermore, nationwide law suits brought against the EPA for failure to clean up impaired waters in a timely manner have challenged the validity of states' 303(d) lists and called into question the quality and quantity of the information underlying the entire water resource assessment process. The substantial cost estimates associated with implementation of the TMDL program nation-wide point to the need for scientifically valid monitoring data for making informed decisions throughout all aspects of the watershed management program.

The shortage of water monitoring data has been acknowledged for quite some time. During the 1990's the EPA and the United States Geological Survey (USGS) formed an Intergovernmental Task Force on Monitoring (ITFM) that convened a series of meetings with interested states and other parties to develop recommendations for improving water quality monitoring in the United States. The ITFM, which later became the National Water Monitoring Council, suggested that monitoring programs should be goal-oriented and include indicators that are tied closely to those goals. Furthermore, increased emphasis was placed on methods comparability, quality assurance/quality control, and the creation of partnerships to meet monitoring needs. On the heels of the recommendations of the ITFM, the EPA introduced the concept of a Consolidated Assessment and Listing Methodology (CALM) that would combine reporting elements of § 305(b) and § 303(d) into one assessment framework. Included in the Draft CALM guidance document are ten "elements of an adequate state ambient water monitoring and assessment program" that, upon full implementation, will result in the comprehensive spatial and temporal coverage of all waters of the state as specified in § 106(e)1 of the CWA. The following ten elements form the basis for enhancing existing state monitoring programs: *Monitoring Program Strategy, Quality Assurance, Monitoring Objectives, Monitoring Design, Core Indicators, Data Management, Data*

Analysis/Assessment, Reporting, Programmatic Evaluation, and General Support and Infrastructure. At the regional level the need to expand and improve current water quality monitoring and assessment programs is also highlighted in recent Environmental Performance Partnership Agreements (PPA) between the MADEP and the EPA.

The MADEP responded to various demands for expanded monitoring resources by providing funding to the USGS to develop a cooperative statewide water quality monitoring plan for Massachusetts. Published in 2001, the final plan includes an evaluation of existing monitoring program elements, as well as the design for a new network consisting of several components, or tiers, each designed to fulfill specific requirements for data and related information. For example, Tier I of the plan is aimed at providing the information needed for making watershed and statewide 305(b) assessments. Tier II is a network of fixed sites to be monitored regularly to determine contaminant loads and long-term trends in water quality. And, Tier III is site- or issue-specific monitoring for purposes of identifying causes and sources of pollution. The complete report can be found at http://water.usgs.gov/pubs/wri/wri014081. The Massachusetts monitoring strategy represents a long-term goal toward which the DWM will move as monitoring and assessment resources become available.

ENVIRONMENTAL INDICATORS

The draft CALM guidance calls for the states to develop and adopt a "core set of monitoring parameters (e.g., water quality parameters) including physical/habitat, chemical/toxicological, and biological/ecological endpoints". The measurement of these "indicators" would provide the information base for determining the impairment status of the water resource. Environmental indicators have received a lot of attention in recent years, but have also led to some confusion as to their purpose and use. The Intergovernmental Task Force on Monitoring Water Quality defined an environmental indicator as "a measurable feature which singly or in combination provides managerial and scientifically useful evidence of environmental and ecosystem quality or reliable evidence of trends in quality". Inherent in this definition is a hierarchy of indicator types ranging from those emphasizing program-focused activities, such as the *number of discharge permits issued*, to greater reliance on resource-focused measures, such as the assessment of *biological integrity*. Note that the former represents, at best, "managerial evidence of environmental quality" as defined above, whereas the latter provides direct "scientific evidence" of ecosystem quality. The kinds of indicators comprising the hierarchy are:

1) Response Indicators - Measures of integrated or cumulative reactions to exposure and stress, such as biological community indices.

2) Exposure Indicators - Measures of environmental variables that suggest a degree of exposure to stressors, such as water-column pollutant levels or ambient toxicity.
3) Stressor Indicators - Activities that impact the aquatic environment, such as pollutant discharges and changes in land-use and habitat.

4) Administrative Indicators - Regulatory actions by the EPA, the State, and local entities and responses by the regulated community.

Each indicator type in the hierarchy represents a step closer to the direct measure of the integrity of the resource than does the category below it. For example, reliance on administrative and stressor indicators is presumptive - actual instream pollutant concentrations are estimated from a knowledge of the magnitude and quality characteristics of upstream discharges or conditions are assumed to be improved if a regulatory action is taken. Exposure indicators, such as pollutant concentrations that can be compared to numerical criteria, provide more reliable evidence of instream conditions but still do not account for site-specific factors influencing the biological response to those pollutant concentrations. Therefore, the site-specific application of biological response indicators, such as macroinvertebrate or fish community analyses, allows for greater confidence in the final water resource assessment. By focusing more in the future on indicators that reflect the actual condition of

the resource, the 305(b)/303(d) process will be strengthened and attention will be shifted toward solving real environmental problems.

USE ASSESSMENT METHODS

INFORMATION SOURCES

Reliable scientific data and technical information are essential for making water use assessments. It is the EPA policy (EPA Order 5360.1 CHG 1) that any organization performing work for or on behalf of EPA must establish a quality system to support the development, review, approval, implementation, and assessment of data collection operations. To this end, the MADEP describes its Quality System in an EPA-approved Quality Management Plan to ensure that environmental data are of known and documented quality and are suitable for their intended use. The DWM will accept and review data and information pertaining to the quality of Massachusetts waters from any and all sources. However, for external sources of information the MADEP requires the following: 1) an appropriate Quality Assurance Project Plan including a laboratory Quality Assurance /Quality Control (QA/QC) plan, 2) use of a state certified lab (certified for the applicable analyses), 3) data management QA/QC are described, and 4) the information be documented in a citable report that includes QA/QC analyses.

The MADEP draws from a diverse information base in order to assess the waters of the State. During the past 35 years the DWM (and its predecessor agency) has collected water quality and biological information at over 3,000 locations in the state and published hundreds of technical reports on this information. A listing of these reports, by watershed, is published annually as "Publications of the Division of Watershed Management, 1963 – (current year)" and is available through the DWM Office in Worcester, Massachusetts.

Specific sources of information used for assessments can be found in individual watershed reports. They include monitoring data reports from state and federal agencies and nongovernmental organizations (NGO), as well as reports on projects resulting from MWI grants or funded through sections 314, 319, 104, or 604(b) of the CWA.

Section 314 of the CWA provided for cooperative agreements between federal, state and local entities to restore publicly owned freshwater lakes and ponds and protect them against degradation. During the late 1970s through the early 1990s diagnostic and feasibility (D&F) studies were completed for several lakes and ponds throughout Massachusetts and these were used in earlier 305(b) assessments and 303(d) listing decisions. Information from these studies continues to carry over into new assessment and listing cycles unless new monitoring information results in a change in their assessment and listing status. Likewise, information contained in the nonpoint source assessment report prepared in 1989 in accordance with the requirements of § 319 is also reflected in 305(b) and 303(d) reporting elements unless more recent information has resulted in a modification of the original assessment.

The following generic list provides sources that are typically consulted when making watershed assessments:

State Agencies

MADFWELE, Division of Marine Fisheries
MADFWELE, Division of Fisheries and Wildlife
MADEP, Water Supply Program
MADEP, Wetlands and Waterways Program
MADEP, Watershed Permitting Program
MADEP, Wastewater Management Program

Massachusetts Coastal Zone Management (CZM)
Massachusetts Department of Environmental Management (DEM)
Massachusetts Department of Public Health (DPH)
Metropolitan District Commission (MDC)
Massachusetts Water Resources Authority (MWRA)

Federal Agencies

U.S. Geological Survey
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

Private Consulting Firms

Various Facilities Plans
Massachusetts Clean Lakes Program 628 projects (70 lakes)
Service Contract for Toxicity Testing

Scientific Organizations

Woods Hole Oceanographic Institute
Water Resources Research Center
Massachusetts Institute for Social and Economic Research
Boston Harbor Symposium Abstracts

Other Sources

Colleges, Universities and associated academic institutions
Watershed and lake associations (citizen monitoring programs)
Various Conservation Commissions (nonpoint source assessment)
Municipal and Industrial NPDES Permit Monitoring Requirements

ASSESSMENT PROCESS OVERVIEW

The CWA 305(b) water quality reporting process is the principal means by which the EPA, Congress, and the public evaluate existing water quality, assess progress made in maintaining and restoring water quality, and determine the extent of remaining problems. In so doing, the states report on waterbodies within the context of meeting their designated uses. These uses include: *Aquatic Life, Fish Consumption, Drinking Water, Primary* and *Secondary Contact Recreation, Shellfishing* and *Aesthetics*. Two subclasses of Aquatic Life are also designated in the standards: Cold Water Fishery (capable of sustaining a year-round population of cold water aquatic life, such as trout), and Warm Water Fishery (waters that are not capable of sustaining a year-round population of cold water aquatic life)

The Surface Water Quality Standards specify the minimum water quality criteria that are needed to sustain the designated uses. Furthermore, these standards prescribe the most severe hydrological conditions at which these minimum criteria apply. For river systems the standards are applied to waters at or above the seven-day ten-year low flow statistic (7Q10). For regulated streams, however, the lowest discharge at which criteria must be met is that equaled or exceeded 99% of the time on a yearly basis or an alternative equivalent flow value agreed upon between the Commissioner of the MADEP and the entity controlling the flow. For coastal and marine waters and lakes the extreme hydrological conditions at which the standards apply is determined by the MADEP on a case-by-case basis.

The EPA provides guidelines to the states for making their use support determinations. For a particular waterbody or segment individual uses are assessed if an adequate amount of data or other information are available for doing so. In many instances waterbodies may be assessed for some uses and not for others. Data and supporting information older than five years are generally considered "historical" and are used primarily for descriptive purposes. However, they can be utilized for use support determination if they are known to reflect current conditions. While the water quality standards prescribe minimum water quality criteria to sustain the designated uses numerical criteria are not available for every indicator of pollution. In some instances available guidance from the scientific literature may be applied in lieu of actual numerical criteria. Excursions from criteria due solely to "naturally occurring" conditions do not constitute violations of the water quality standards.

Each designated use within a given waterbody segment is individually assessed as 1*) support*, 2) *partial support*, or 3) *non-support*. The term *threatened* is used when a use is fully supported but is not expected to support the use within two years because of adverse pollution trends or anticipated sources of pollution. When too little current data or information exists, or no reliable data are available, the use is *not assessed.* All use assessments are stored in an electronic database called the Water Body System (WBS). Detailed information on how each individual use is assessed is provided in each watershed assessment report and is summarized below. It is important to note, however, that not all waters are assessed. Many small and/or unnamed ponds, rivers, and estuaries may never have been monitored and remain unassessed. Therefore, the status of their designated uses has never been reported to the EPA in a 305(b) report nor is there information on these waters in the WBS database.

INDIVIDUAL USE ASSESSMENTS

Aquatic Life Support

Waters designated for this use must provide suitable habitat for sustaining a native, naturally diverse community of aquatic flora and fauna. Two subclasses of aquatic life are also designated in the standards for freshwater bodies: *Cold Water Fishery* - capable of sustaining a year-round population of cold water aquatic life, such as trout; *Warm Water Fishery* - waters that are not capable of sustaining a year-round population of cold water aquatic life.

Biological (including habitat evaluations), toxicological and chemical data may all be utilized to assess this use. However, these data categories represent different levels within the indicator hierarchy described earlier. Therefore, the level of confidence ascribed to the various indicator types along with the nature and frequency of the MADEP's data collection techniques dictate that a "weight of evidence" approach be used to complete the assessment with biomonitoring results used as the final arbiter of borderline cases.

The chart on the next page provides an overview of the guidance used to assess the status (support, partial support, non-support) of the aquatic life use.

AQUATIC LIFE SUPPORT

Variable (#) - Indicates reference provided at the end of the individual use section	***Support*** – Data available clearly indicates support. Minor excursions from chemical criteria may be tolerated if the biosurvey results demonstrate support.	***Partial Support*** – Uncertainty about support in the chemical or toxicity testing data, or there is some minor modification of the biological community. Excursions not frequent or prolonged.	***Non-Support*** – There are frequent or severe violations of chemical criteria, presence of acute toxicity, or a moderate or severe modification of the biological community.
BIOLOGY			
Rapid Bioassessment Protocol (RBP) II or III (4)	Non-Impaired	Slightly Impaired	Moderately or Severely Impaired
Fish Community (4)	Best Professional Judgment (BPJ)	BPJ	BPJ
Habitat and Flow (4)	BPJ	BPJ	Dewatered streambed due to artificial regulation or channel alteration
Macrophytes (4)	BPJ	Exotic plant species present, but not dominant, BPJ	Exotic plant species dominant, BPJ
Plankton/ Periphyton (4)	No algal blooms	Occasional algal blooms	Persistent algal blooms
TOXICITY TESTS			
Water Column/Ambient (4)	>75% survival either 48 hr or 7-day exposure	>50 - ≤75% survival either 48 hr or 7-day exposure	≤50% survival either 48 hr or 7-day exposure
Effluent (4)	Meets permit limits	(NOTE: if limit is not met, the stream is listed as threatened for 1.0 river mile downstream from the discharge.)	
Sediment (4)	>75% survival	>50 - ≤75% survival	≤50% survival
CHEMISTRY- WATER			
DO (3, 6)	Criteria exceeded in ≤10% of measurements	Criteria exceeded in 11-25% of measurements (surface area for lakes)	Criteria exceeded >25% of measurements.
pH (3, 6)	Criteria exceeded in ≤10% of measurements	Criteria exceeded in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Temperature **(**3, 6) [1]	Criteria met [1]	Criteria exceeded in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Turbidity (4)	Δ 5 NTU due to a discharge	BPJ	BPJ
Suspended Solids (4)	25 mg/L max., Δ10 mg/L due to a discharge	BPJ	BPJ
Nutrients (3) Phosphate-P (4)	(Balanced Biocommunity maintained; no pH/DO violations)	BPJ	BPJ
Toxic Pollutants (3, 6) Ammonia-N (3, 4, 13) [2] Chlorine (3, 6) [3]	Criteria met 0.204 mg/L NH_3-N [2] 0.011 mg/L TRC[3]	BPJ	Criteria exceeded in > 10% of samples.
CHEMISTRY – SEDIMENT			
Toxic Pollutants (5) [4]	≤ Low Effect Level (L-EL)[4]	One pollutant between L-EL and Severe Effect Level (S-EL)	One pollutant ≥ S-EL (severe)
Nutrients (5)	≤ L-EL	Between L-EL and S-EL	≥ S-EL
Metal Normalization to Al or Fe (4)	Enrichment Ratio ≤ 1	Enrichment Ratio >1 but ≤10	Enrichment Ratio ≥10
CHEMISTRY- EFFLUENT			
Compliance with permit limits (4)	In-compliance with all limits	NOTE: If the facility does not meet their permit limits, the information is used to threaten one river mile downstream from the discharge.	
CHEMISTRY-TISSUE			
PCB – whole fish (1)	≤500 μg/kg wet weight	BPJ	BPJ
DDT (2)	≤14.0 μg/kg wet weight	BPJ	BPJ
PCB in aquatic tissue (2)	≤0.79 ng TEQ/kg wet weight	BPJ	BPJ

[1] maximum daily mean T in a month (minimum six measurements evenly distributed over 24-hours) less than criterion,
[2] [NH_3-N] at pH = 9.0 SU and 28°C, actual "criterion" varies with pH and temperature and is evaluated case-by-case.
[3] The minimum quantification level for TRC is 0.05 mg/L. [4] For the purpose of this report, the S-EL for total PCB in sediment (which varies with TOC content) with 1% TOC is 5.3 ppm while a sediment sample with 10% TOC is 53 ppm.

Note: National Academy of Sciences/National Academy of Engineering (NAS/NAE) guideline for maximum organochlorine concentrations (i.e., total PCB) in fish tissue for the protection of fish-eating wildlife is 500μg/kg wet weight (ppb, not lipid-normalized). PCB data (tissue) in this report are presented in μg/kg wet weight (ppb) and are not lipid-normalized to allow for direct comparison to the NAS/NAE guideline.

Fish Consumption Use

Pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (MDPH), Bureau of Environmental Health Assessment. The MDPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species poses a health risk for human consumption. Hence, the Fish Consumption Use is assessed as non-support in these waters. A list of all DPH site-specific fish consumption advisories currently in force can be found in the appendix.

In July 2001, MDPH issued new consumer advisories on fish consumption and mercury contamination. The MDPH "…is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age."

Additionally, MDPH "…is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury."

MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. Because of the statewide advisory, however, no waters can be assessed as support or partial support for the *Fish Consumption Use*. The following is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Fish Consumption Use*.

Variable (#) - Indicates reference provided at the end of the individual use section	***Support*** – No restrictions or bans in effect	***Partial Support*** – A "restricted consumption" fish advisory is in effect for the general population or a sub-population that could be at potentially greater risk (e.g., pregnant women, and children	***Non-Support*** – A "no consumption" advisory or ban in effect for the general population or a sub-population for one or more fish species; or there is a commercial fishing ban in effect
MDPH Fish Consumption Advisory List (8,12)	Not applicable, precluded by statewide advisory (Hg)	Not applicable	Waterbody on MDPH Fish Consumption Advisory List

Other statewide advisories that MDPH has previously issued and are still in effect are as follows:

1. Due to concerns about chemical contamination, primarily from polychlorinated biphenyl compounds (PCB) and other contaminants, no individual should consume lobster tomalley from any source. Lobster tomalley is the soft green substance found in the tail and body section of the lobster.

2. Pregnant and breastfeeding women and those who are considering becoming pregnant should not eat bluefish due to concerns about PCB contamination in this species.

Drinking Water Use

The term *Drinking Water Use* denotes those waters used as a source of public drinking water. These waters may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). They are designated for protection as Outstanding Resource Waters (ORWs) in 314 CMR 4.04(3). The MADEP's Drinking Water Program (DWP) has primacy for implementing the provisions of the Federal Safe Drinking Water Act (SDWA). Except for suppliers with surface water sources for which a waiver from filtration has been granted (these systems also monitor surface water quality) all public drinking water supplies are monitored as finished water (tap water). Monitoring includes the major categories of contaminants established in the SDWA: bacteria, volatile and synthetic organic compounds, inorganic compounds and radionuclides. The DWP maintains current drinking supply monitoring data that are reported to the EPA in accordance with SDWA requirements. The status of the supplies was formerly reported on a statewide basis to the EPA in the 305(b) report. However, this use is not assessed in individual DWM watershed assessment reports. The EPA's guidance for assessing the status (support, partial support, non-support) of the drinking water use is as follows.

Variable (#) - Indicates reference provided at the end of the individual use section	***Support*** – No closures or advisories (no contaminants with confirmed exceedances of maximum contaminant levels, conventional treatment is adequate to maintain the supply).	***Partial Support*** – Is one or more advisories or more than conventional treatment is required	***Non-Support*** – One or more contamination-based closures of the water supply
Drinking Water Program (DWP) Evaluation	See note below	See note below	See note below

Note: While this use is not assessed in the DWM watershed assessment reports, information on drinking water source protection and finish water quality is available at http://www.state.ma.us/dep/brp/dws/dwshome.htm and from individual public water suppliers.

Section 1453 of the SDWA requires each state to develop a comprehensive Source Water Assessment Program (SWAP) that will result in assessments of every public water system in the state. These assessments are to include the delineation of the areas needed to protect the drinking water source, an inventory of potential contaminant sources, and a determination of the water's susceptibility to contamination. While Massachusetts is currently implementing the provisions of § 1453, actual ambient water quality data have not been obtained and SWAP assessments were not yet available for the watershed assessments supporting the 2002 Integrated List of Waters. The MADEP anticipates using this information in future assessments as it becomes available.

Shellfishing Use

This use is assessed with information generated primarily from the Department of Fisheries, Wildlife and Environmental Law Enforcement's Division of Marine Fisheries (DMF), however other data are used when available. Bacteria criteria that apply to open and restricted shellfishing can be found in the Massachusetts Surface Water Quality Standards and in each DWM watershed assessment report. A designated shellfish growing area is an area of potential shellfish habitat. Growing areas are managed with respect to shellfish harvest for direct human consumption, and comprise at least one or more classification areas. The classification areas are the management units and they range from approved to prohibited (listed below) with respect to shellfish harvest. Shellfish areas under management closures are *not assessed.*

Variable (#) - Indicates reference provided at the end of the individual use section	***Support*** – SA Waters—Approved[1] SB Waters— Approved[1], Conditionally Approved[2] or Restricted[3]	***Partial Support*** – SA Waters— Conditionally Approved[2], Restricted[3], or Conditionally Restricted[4] SB Waters—Conditionally Restricted[4]	***Non Support*** – SA Waters—Prohibited[5] SB Waters— Prohibited[5]
Division of Marine Fisheries Shellfish Project Classification Area Information (11)	Reported by DMF	Reported by DMF	Reported by DMF

[1] **Approved** - "...open for harvest of shellfish for direct human consumption subject to local rules and regulations..." An approved area is open all the time and closes only due to hurricanes or other major coastwide events.

[2] **Conditionally Approved** - "...subject to intermittent microbiological pollution..." During the time the area is open, it is "...for harvest of shellfish for direct human consumption subject to local rules and regulations…" A conditionally approved area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, shellfish harvested are treated as from an approved area.

[3] **Restricted** - area contains a "limited degree of pollution." It is open for "harvest of shellfish with depuration subject to local rules and state regulations" or for the relay of shellfish. A restricted area is used by DMF for the relay of shellfish to a less contaminated area.

[4] **Conditionally Restricted** - "...subject to intermittent microbiological pollution..." During the time area is restricted, it is only open for "the harvest of shellfish with depuration subject to local rules and state regulations." A conditionally restricted area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, only soft-shell clams may be harvested by specially licensed diggers (Master/Subordinate Diggers) and transported to the DMF Shellfish Purification Plant for depuration (purification).

[5] **Prohibited -** Closed for harvest of shellfish.

Primary Contact Recreational Use

This use is suitable for any recreational or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water (1 April to 15 October). These include, but are not limited to, wading, swimming, diving, surfing and water skiing. In 2000 Congress passed the Beaches Environmental Assessment and Coastal Health Act (BEACH Act). This legislation amended the CWA to improve § 304(a) criteria for pathogen indicators and to provide financial support for state coastal recreation water monitoring and public notification programs. Due to its recent passage, BEACH Act monitoring data were not yet available for use in the assessments supporting the development of the 2002 Integrated List of Waters. The MADEP anticipates receiving and using data from this program in future assessments. The MADEP does use information pertaining to designated beach closings in its recreational use assessments. The chart below provides an overview of the guidance used to assess the status (support, partial support, non-support) of the *Primary Contact Use*.

Variable (#) - Indicates reference provided at the end of the individual use section	***Support*** – Criteria are met, no aesthetic conditions that preclude the use	***Partial Support*** – Criteria exceeded intermittently (neither frequent nor prolonged), marginal aesthetic violations	***Non-Support*** – Frequent or prolonged violations of criteria, formal bathing area closures, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (3, 9)	>5 samples--≤200 cfu/100mL geometric mean OR if <5 samples--≤400/100mL maximum	Criteria exceeded in 11-25% of the samples	Criteria exceeded in > 25% of the samples
pH (3, 6)	Criteria exceeded in ≤10 % of the measurements	Criteria exceeded in 11-25% of the measurements	Criteria exceeded in >25% of the measurements
Temperature (3)	Criteria met	Criteria exceeded 11-25% of the time	Criteria exceeded 25% of the time
Color and Turbidity (3, 6)	BPJ, ∆ 5 NTU (due to a point or nonpoint discharge) exceeded in ≤10 % of the measurements	BPJ, Guidance exceeded in 11-25% of the measurements	BPJ, Guidance exceeded in >25% of the measurements
Secchi disk depth (10) *	≥1.2 meters (≥ 4')	Infrequent excursions from the guidance	Frequent and/or prolonged excursions from the guidance
Oil & Grease (3)	Criteria met	BPJ, criteria exceeded 11-25% of the time	BPJ, criteria exceeded >25% of the time
Aesthetics (3) Biocommunity (4)*	No nuisance organisms that render the water aesthetically objectionable or unusable, BPJ; Cover of macrophytes < 50% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes 50-75% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes >75 within any portion of the lake area at maximum extent of growth.

Note: Excursions from criteria due to natural conditions are not considered impairment of use.

*Any portion of a waterbody exhibiting impairment of the *Primary Contact Recreation Use* (swimmable) because of macrophyte cover and/or transparency (Secchi disk depth) is assessed as either partial or non-support. If no fecal coliform bacteria data are available and the waterbody (entirely or in part) met the transparency (Secchi disk depth) and aesthetics guidance, this use is not assessed.

For the *Primary Contact Recreation Use* the following steps are taken to interpret the fecal coliform bacteria results:

1. Identify the range of fecal coliform bacteria counts,
2. Calculate the geometric mean (monthly, seasonally, or on dataset), [Note: the geometric mean is only calculated on datasets with >5 samples collected within a 30-day period.]
3. Calculate the percentage of sample results exceeding 400 colony forming units (cfu)/100mL,
4. Apply the following to interpret data:
    - ≤10% of the samples exceed criteria (step 2 and/or 3, above) - assess as Support,
    - 11-25% of the samples exceed criteria (step 2 and/or 3, above) - assess as Partial Support,
    - >25% of the samples exceed criteria (step 2 and/or 3, above) - assess as Non-Support.

Secondary Contact Recreational Use

This use is suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities. Following is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Secondary Contact Use*.

Variable (#) - Indicates reference provided at the end of the individual use section	***Support*** – Criteria are met, no aesthetic conditions that preclude the use	***Partial Support*** – Criteria exceeded intermittently (neither frequent nor prolonged), marginal aesthetic violations	***Non-Support*** – Frequent or prolonged violations of criteria, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (4)	<5 samples--≤2000 cfu/100mL maximum >5 samples--≤1000 cfu/100mL geometric mean ≤ 10% samples ≥2000 cfu/100mL	Criteria exceeded in 11-25% of the samples	Criteria exceeded in > 25% of samples
Oil & Grease (3)	Criteria met	Criteria exceeded 11-25% of the time, BPJ	Criteria exceeded >25% of the time, BPJ
Aesthetics (3) Biocommunity (4) *	No nuisance organisms that render the water aesthetically objectionable or unusable, BPJ; Cover of macrophytes < 50% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes 50-75% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes >75 within any portion of the lake area at maximum extent of growth.

Note: Excursions from criteria due to natural conditions are not considered impairment of use.

* In lakes if no fecal coliform data are available, macrophyte cover is the only criterion used to assess the *Secondary Contact Recreational Use*.

For the *Secondary Contact Recreation Use* the following steps are taken to interpret the fecal coliform bacteria results:

1. Identify the range of fecal coliform bacteria counts,
2. Calculate the geometric mean (monthly, seasonally, or on dataset), [Note: the geometric mean is only calculated on datasets with >5 samples collected within a 30-day period.]
3. Calculate the percentage of sample results exceeding 2000 colony forming units (cfu)/100mL,
4. Apply the following to interpret data:
    - ≤10% of the samples exceed criteria (step 2 and/or 3, above) - assess as Support,

- 11-25% of the samples exceed criteria (step 2 and/or 3, above) - assess as Partial Support,
- >25% of the samples exceed criteria (step 2 and/or 3, above) - assess as Non-Support.

Aesthetics Use

All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life. The aesthetic use is closely tied to the public health aspects of the recreational uses (swimming and boating). Below is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Aesthetics Use*.

Variable (#) - Indicates reference provided at the end of the individual use section	***Support*** – 1. No objectionable bottom deposits, floating debris, scum, or nuisances; 2. No objectionable odor, color, taste or turbidity, or nuisance aquatic life	***Partial Support*** – Objectionable conditions neither frequent nor prolonged	***Non-Support*** – Objectionable conditions frequent and/or prolonged
Aesthetics (3)* Visual observation (4)	Criteria met	BPJ (spatial and temporal extent of degradation)	BPJ (extent of spatial and temporal degradation)

*For lakes, the aesthetic use category is generally assessed at the same level of impairment as the more severely impaired recreational use category (*Primary* or *Secondary Contact*).

Designated Use References

1. Coles, J.C. 1998.*Organochlorine Compounds in Fish Tissue from the Connecticut, Housatonic and Thames River Basins Study Unit, 1992-94.* National Water-Quality Assessment Program. U.S. Department of the Interior, U.S. Geological Survey. Marlborough, MA.
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REPORTING ON MASSACHUSETTS WATERS

MASSACHUSETTS SUMMARY OF WATER QUALITY (305b) REPORTS

Massachusetts published 305(b) *Summary of Water Quality* reports annually from 1977-1979 and biennially from 1982 through 2000. These reports presented an overview of the monitoring program, the assessment methodology and, for those waters assessed, the number of stream miles or lake and coastal area supporting their designated uses. The earlier 305(b) reports included individual segment-by-segment watershed summaries as well as the statewide use support status. In addition, an attempt was made to compile pertinent information pertaining to the quality of the states' wetlands and groundwater resources. Finally, selected statewide water quality issues of concern, such as acid precipitation or mercury contamination, were discussed in limited detail.

In 1988, the EPA introduced a new automated data management system to store the results of water quality assessments and manage new assessment information called for in the Water Quality Act of 1987. By the time of the 1992 reporting cycle Massachusetts was utilizing this automated database, known as the Waterbody System (WBS), to improve consistency in determining use support and to compile use support information statewide. Because the individual watershed segment-by-segment assessments were stored in the WBS, this detailed information was no longer included in the annual 305(b) paper report. Rather, an electronic version of the WBS reflecting the most recent assessment information was included as part of the 305(b) package submitted to the EPA. Beginning with the 1994 report (actually published in 1995) only the statewide summaries were presented in the hard copy reports and the individual segment information was provided in the "electronic update." This arrangement proved to be very effective for reporting basic statewide information to the EPA and Congress. However, watershed teams and other interested parties were much more interested in obtaining information pertaining to specific local waterbodies in order to prioritize problems and focus remedial actions. To meet the increasing demand for data and information to support the MWI, therefore, the DWM has developed individual watershed assessment reports that supplement the traditional 305(b) reporting process.

WATERSHED ASSESSMENT REPORTS

Working cooperatively with the MADEP regional offices and the EOEA teams, the DWM prepares individual watershed assessment reports during Year 3 of the watershed management cycle. These reports are a synthesis of many kinds of information pertaining to the ecological and regulatory status of the water resources in the respective watersheds. Each report presents a description of the geophysical characteristics and land uses in the watershed along with information on wastewater discharges, water withdrawals and other issues affecting water quality and ecosystem integrity. The main feature of the watershed assessment report is a summary of the current water quality data and information used to assess the status of the designated uses as defined in the Water Quality Standards. This includes a description and results of the monitoring activities carried out by the DWM in the previous year ("Year 2") as well as documentation of external sources of data utilized in the assessments. Use-support determinations are made, as described in the previous section of this report, for each waterbody segment for which adequate data and information are available. However, many waters remain unassessed for one or more uses in any given assessment cycle and many small and/or unnamed streams and ponds have never been monitored and assessed. Finally, the watershed reports include segment-by-segment recommendations for further actions, such as additional monitoring to confirm use-support decisions or identify causes and sources of impairment or steps to be taken to correct known problems.

While the DWM published the first set of watershed assessment reports in 2000, these actually represented "Year 2" monitoring activities carried out in 1997. Draft reports were compiled for the 1995 and 1996 monitoring years, but these were never published. Report preparation is

continuing sequentially as an integral step in the watershed management cycle. For a list of the most recent assessment report for each watershed see the box below.

DWM Watershed Assessment Reports

1. DeCesare, G.J. and S.G. Connors. 2002. C*ape Cod Watershed Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
2. DeCesare, G.J., L.E. Kennedy and M.J. Weinstein. 2000. *North Coastal Watershed 1997/1998 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
3. Fiorentino, J.F., L.E. Kennedy and M.J. Weinstein. 2000. *Charles River Watershed 1997/1998 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
4. Kennedy, L.E., S. Kiras and R. McVoy. 2001. *Merrimack River Basin 1999 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
5. Kennedy, L.E., S. Kiras and R. McVoy. 2002. *French & Quinebaug River Watersheds 2001 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
6. Kennedy, L.E., R.J. Maietta and J.F. Fiorentino. 2000. *Ten Mile River Basin 1997 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
7. Kennedy, L.E. and M.J. Weinstein. 2000. *Housatonic River Basin 1997/1998 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
8. Kennedy, L.E. and M.J. Weinstein. 2000. *Hudson River Basin 1997 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
9. Kennedy, L.E., M.J. Weinstein and R.J. McCollum. 2000. *Connecticut River Basin 1998 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management (Worcester, MA.) and Western Regional Office (Springfield, MA.)
10. MADEP. Undated. *DRAFT Buzzards Bay Watershed 1995 Resource Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
11. MADEP. Undated. *DRAFT Deerfield River Watershed 1995 Resource Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
12. MADEP. Undated. *DRAFT Ipswich River Watershed 1995 Resource Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
13. MADEP. Undated. *DRAFT Islands Watershed 1995 Resource Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
14. MADEP. Undated. *DRAFT Millers River Watershed 1995 Resource Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
15. MADEP. Undated. *DRAFT Shawsheen River Watershed 1995 Resource Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
16. MADEP. Undated. *DRAFT Farmington River Watershed 1996 Resource Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
17. MADEP. Undated. *DRAFT South Coastal Watershed 1996 Resource Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
18. MADEP. Undated. *DRAFT SuAsCo River Watershed 1996 Resource Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
19. MADEP. Undated. *DRAFT Taunton Watershed 1996 Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
20. MADEP. Undated. *DRAFT Westfield River Watershed 1996 Resource Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
21. O'Brien, K., M.J. Weinstein and R. McVoy. 2002. *Boston Harbor 1999 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
22. Weinstein, M.J. and S.G. Connors. 2001. *Parker River Watershed Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
23. Weinstein, M.J., L.E. Kennedy and J. Colonna-Romano. 2001. *Nashua River Basin 1998 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
24. Weinstein, M.J., L.E. Kennedy, J. Colonna-Romano and T. Beaudoin. 2001. *Blackstone River Basin 1998 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management and Central Regional Office, Worcester, MA.
25. Weinstein, M.J., L.E. Kennedy, J. Colonna-Romano, R.J. McCollum and W.A. Kimball. 2001. *Chicopee River Basin 1998 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management (Worcester, MA), Western Regional Office (Springfield, MA) and Central Regional Office (Worcester, MA).
26. Weinstein, M.J., P. Mitchell and K. O'Brien. 2002. *Narragansett/Mt. Hope Bay Watershed 1999 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

Copies of the watershed assessment reports are distributed to the EPA in partial fulfillment of the

PPA and to the EOEA watershed teams and other interested parties. In addition, the published reports can be found at http://www.state.ma.us/dep/brp/wm/wqassess.htm.

MASSACHUSETTS LISTS OF IMPAIRED WATERS

Section 303(d) of the CWA requires states to periodically identify and list those waterbodies for which existing controls on point and nonpoint sources of pollutants are not stringent enough to attain or maintain compliance with applicable surface water quality standards. Furthermore, the CWA specifies that the states calculate, for each impaired waterbody, the maximum amount of pollutant that the water can receive without violating water quality standards. Once derived, this capacity for a water to accept a quantity of pollutant without impairing its uses, expressed as a total maximum daily load or TMDL, is apportioned among point discharges and nonpoint sources while allowing for background levels and a margin of safety. Thus, the 303(d) List identifies and prioritizes waters in need of further clean-up and the TMDL process provides the mechanism for allocating allowable pollutant loads.

Regulations governing the preparation of the 303(d) List, first issued in 1978 and amended once in 1985 and again in 1992, specify that states must submit a list of impaired waters to the EPA on or before April 1 of even-numbered years. Furthermore, the regulations require that states consider all "existing and readily available water quality-related data and information" when compiling their lists. This includes the Summary of Water Quality (305b) Report, NPDES discharge monitoring records, DPH fish consumption advisories, data from other federal and state agencies, and citizen monitoring data. States must include on the lists the specific pollutant(s) or stressor(s) causing impairment (if known) and a priority ranking for completing TMDLs. Finally, the draft list must be made available to the public for their review and comment before a final list is submitted to the EPA for approval.

Massachusetts developed 303(d) Lists in 1992, 1994, 1996, and 1998. The 1994 submittal consisted of little more than a letter to the EPA stating that the 303(d) List remained unchanged from the 1992 version. Each of the revisions that followed incorporated new information for those waters that had been assessed since the previous version was published but did not represent a completely new statewide listing. Each list was subjected to public review and comment and subsequently approved by the EPA.

By the mid-1990s the water pollution abatement program mandated by the CWA was the subject of nationwide controversy. Specifically, numerous lawsuits were brought against the EPA and various states for their lack of progress toward developing TMDLs and restoring polluted waters. The EPA responded in 1996 by establishing a Federal Advisory Committee on the TMDL Program that was charged with recommending ways to improve the effectiveness of the 303(d)-related programs. Formed under the authority of the Federal Advisory Committee Act (FACA), this committee was made up of individuals exhibiting several areas of expertise and representing a broad range of perspectives on the Clean Water Act. The committee reviewed the 303(d) listing process, TMDL scheduling and development, opportunities for public participation, and the EPA's role in TMDL review and coordination of the program. Based, in part, on the recommendations of the FACA committee the EPA issued revisions to the TMDL Program in July 2000 that were intended to strengthen state TMDL programs. Moreover, the EPA began to formulate new guidance to states in the form of a *Consolidated Assessment and Listing Methodology* (CALM) that ultimately appeared in draft form in May 2001. Finally, the EPA made it optional for states to prepare a 303(d) list in 2000 and Massachusetts decided to focus limited personnel resources on TMDL development rather than updating the 1998 list.

The development of the "new rule", as the July 2000 regulation came to be known, prompted further nationwide comment and controversy to the point where Congress attached a rider to an unrelated appropriations bill. That rider prohibited the EPA from funding any activities related to the implementation of the "new rule" in FY 2000 and 2001 pending a thorough review of the scientific basis for the TMDL Program. This review, completed in only four months by the National Research Council (NRC), concluded that the TMDL Program represented a sound approach to cleaning the

Nation's impaired waters, but that it needed strengthening in many areas. The NRC Report, published in 2001, called for improvements in the states' water quality standards to better define designated uses and for stronger monitoring programs for assessing and listing impaired waters and supporting TMDL development. The EPA responded to the report by postponing the effective date of the new rule for eighteen months to provide time to invite more comment and make further revisions.

YEAR 2002 INTEGRATED LIST OF MASSACHUSETTS WATERS

With the lack of a new TMDL regulation and CALM guidance still in draft form, the EPA released guidance to the states on November 19, 2001 for the preparation of an *Integrated List of Waters* to be submitted to the EPA in 2002 that would meet the reporting requirements of both § 305(b) and § 303(d).

The integrated list format allows states to provide the current status of all their assessed waters in a single multi-part list. States choosing this option would place each waterbody or segment thereof in one of the following five categories:

1) Unimpaired and not threatened for all designated uses;
2) Unimpaired for some uses and not assessed for others;
3) Insufficient information to make assessments for any uses;
4) Impaired or threatened for one or more uses but not needing a TMDL; and
5) Impaired or threatened for one or more uses and requiring a TMDL.

Thus, the waters listed in Category 5 are the 303(d) List and, as such, are reviewed and approved by the EPA. The remaining four categories are submitted in fulfillment of the requirements under § 305(b), essentially replacing the old 305(b) Report format.

In order to give states enough time to adjust to the new format, the *Integrated List of Waters* is due to the EPA on October 1, 2002 rather than in April. The EPA acknowledges that not all states are in a position to submit an integrated list for 2002. Therefore, states are also provided the option of submitting separate 305(b) and 303(d) documents as in previous years. Moreover, the EPA is allowing states to work toward the goal of developing an integrated list of waters even if all features of the new format called for in the guidance are not provided in the 2002 submittal.

Massachusetts' proposal to progress toward an integrated list of waters for 2002 was outlined in a letter dated February 14, 2002 from the DWM Director Glenn Haas to Dave Webster of the EPA. The letter states that a five-category list will be produced in accordance with the guidance, but that several other provisions in the guidance would not be implemented for 2002. For example, while the EPA will ultimately require that states adopt a new Assessment Data Base (ADB) for storing assessment information, Massachusetts is relying on the information stored in the Water Body System (WBS) for one more reporting cycle with the goal of converting to the use of the ADB for reporting in 2004.

The new EPA guidelines also specify that each state submit a comprehensive assessment and listing methodology and detailed monitoring strategy as part of the integrated list package. Although the CALM document (First Edition) was finally published in July 2002, it was not available in time for states to use it in developing the 2002 integrated list. For 2002, the MADEP is relying on Part 1 of its 2002 Integrated List Report contained herein and the individual watershed assessment reports prepared by the DWM to provide the rationale and supporting information pertaining to how assessments were made and what monitoring is needed in the future to fill data gaps.

Finally, the new EPA guidance for the development of Category 5 of the integrated list is consistent with past requirements of § 303(d) in that a TMDL schedule is called for that reflects the priority ranking of each water segment/pollutant combination. In 1998 the MADEP formulated

a TMDL Strategy that presented the TMDL efforts to be undertaken in the ensuing years. This strategy was made available for public review and comment concurrent with the Draft 1998 303(d) List. Since that time several TMDLs have- been completed and approved by the EPA and these are identified as such in the 2002 Integrated List. A general priority ranking for TMDL development does exist for the 2002 Integrated List of Waters. However, each waterbody remaining on the 303(d) List in 2002 (i.e., Category 5) has not been assigned an individual priority level. Nonetheless, the priorities for TMDL development of the MADEP remain consistent with the original TMDL Strategy and a more detailed prioritization will be provided with the next list. The MADEP takes into account the severity of the impairment and the uses to be made of the waterbodies when developing updated priorities. This is reflected in the TMDLs that have been selected for development in the near future.

Massachusetts has already taken several steps toward refining the original TMDL Strategy. The "Massachusetts Total Maximum Daily Load (TMDL) Program Evaluation" was initiated in 2001 by the consulting firm CH2M Hill under contract with the MADEP. The goals of this evaluation were to 1) provide an external assessment of the technical, resource and financial management challenges associated with the EPA's newly proposed TMDL Rule; 2) develop alternative and innovative resource management and funding approaches to provide for the effective implementation of the TMDL program; and 3) develop a state-wide communications plan to build support for TMDL development and implementation. A TMDL steering committee, consisting of representatives of public, private and governmental groups participated in a series of workshops devoted to important topics related to implementation of the TMDL program such as 303(d) listing and de-listing, prioritization of TMDL development, roles and responsibilities of interested parties, communicating and implementing TMDLs, etc. Massachusetts plans to use the input and recommendations generated during this program evaluation process to set priorities for future TMDL activities. However, the evaluation is not yet completed and final recommendations are in development. Some of the committee recommendations were incorporated into the 2002 Integrated List of Waters. For example the decision to re-evaluate lakes 303(d)-listed in the past based solely on the presence of nuisance growths of aquatic macrophytes was the result of input from the committee. The MADEP intends to use the recommendations of the TMDL committee to develop an updated TMDL Strategy over the next several months that will set the priorities for TMDL development in the future.

In addition to the project described above several waters have been "targeted" for TMDL development and projects involving close cooperation between the MADEP and local partners are now underway. These are the ongoing TMDL efforts in the Shawsheen, SuAsCo (Assabet), Charles and Nashua river basins. In addition, the MADEP is cooperating with the EPA and the State of Rhode Island on TMDL activities on two shared watersheds, the Palmer and Kickamuit rivers.

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Appendix

Freshwater Fish Consumption Advisory List

Massachusetts Department of Public Health
Bureau of Environmental Health Assessment
June, 2002

WATER BODY	TOWN(s)	FISH ADVISORY*	HAZARD*
Aaron River Reservoir	Cohasset, Hingham, Scituate	P1 (all species), P2 (CP, YP), P4	Mercury
Ames Pond	Tewksbury	P1 (LMB), P3 (LMB)	Mercury
Ashumet Pond	Mashpee, Falmouth	P1 (LMB), P3 (LMB)	Mercury
Attitash, Lake	Amesbury, Merrimac	P1 (all species), P2 (LMB), P4	Mercury
Baldpate Pond	Boxford	P1 (all species), P2 (LMB), P4	Mercury
Ballardvale Impoundment of Shawsheen River	Andover	P1 (LMB & BC), P3 (LMB & BC)	Mercury
Bare Hill Pond	Harvard	P1 (LMB), P3 (LMB)	Mercury
Big Pond	Otis	P1 (all species), P2 (LMB), P4	Mercury
Blackstone River above Blackstone Gorge	Blackstone	P1 (all species), P2 (C & WS)	PCBs
Boon, Lake	Hudson, Stow	P1 (LMB & BC), P3 (LMB & BC)	Mercury
Buffomville Lake	Charlton, Oxford	P1 (all species), P5	Mercury
Burr's Pond	Seekonk	P1 (LMB), P3 (LMB)	Mercury
Cabot Pond - See Rumford River			
Cedar Swamp Pond	Milford	P1 (all species), P5	Mercury
Chadwicks Pond	Boxford, Haverhill	P6	Mercury
Charles River (Between the South Natick Dam in Natick and the Museum of Science Dam in Boston/ Cambridge)	Boston, Cambridge, Dedham, Dover, Natick, Needham, Newton, Watertown, Wellesley, Weston, Waltham	P1 (C, LMB), P2 (C), P3 (LMB)	PCBs and pesticides
Charles River (Between the South Natick Dam in Natick and the Medway Dam in Franklin and Medway)	Dover, Franklin, Medfield, Medway, Millis, Natick, Norfolk, Sherborn	P1 (LMB), P3 (LMB)	Mercury
Chebacco Lake	Essex, Hamilton	P1 (LMB), P3 (LMB)	Mercury

WATER BODY	TOWN(s)	FISH ADVISORY*	HAZARD*
Clay Pit Pond	Belmont	P6	Chlordane
Cochato River, Ice Pond and Sylvan Lake	Randolph, Holbrook, Braintree	P1 (all species), P2 (BB & C & AE), P4	Pesticides
Cochichewick, Lake	North Andover	P1 (LMB), P3 (LMB)	Mercury
Cochituate, Lake	Framingham, Natick, Wayland	P1 (all species), P2 (AE)	PCBs
Concord River	Concord, Carlisle, Bedford, Billerica	P1 (all species), P2 (LMB), P4	Mercury
Connecticut River	All towns between Northfield and Longmeadow	P1 (all species), P2 (CC & WC & AE & YP)	PCBs
Copicut River, Cornell Pond	Dartmouth	P1 (all species), P2 (AE), P3 (LMB)	PCBs, Mercury
Crystal Lake	Haverhill	P1 (all species), P2 (LMB), P4	Mercury
Dennison, Lake	Winchendon	P1 (LMB), P3 (LMB)	Mercury
Drinkwater River/ Indian Head River and Factory Pond (See footnote 1)	Hanson, Hanover, Pembroke	P6	Mercury
East Brimfield Reservoir - See Quinebaug River			
East Monponsett Pond	Halifax	P1 (LMB), P3 (LMB)	Mercury
Factory Pond - See Drinkwater River			
Flint Pond	Tyngsborough	P1 (all species), P2 (LMB), P4	Mercury
Forest Lake	Methuen	P1 (LMB), P3 (LMB)	Mercury
Fosters Pond	Andover	P1 (all species), P5	Mercury
Freeman Lake – See Newfield Pond			
Fulton Pond - See Rumford River			
Gales Pond	Warwick	P1 (YP), P3 (YP)	Mercury
Gibbs Pond	Nantucket	P1 (all species), P5	Mercury
Goodrich Pond	Pittsfield	P6	PCBs
Great Herring Pond	Bourne, Plymouth	P1 (SMB), P3 (SMB)	Mercury

WATER BODY	TOWN(s)	FISH ADVISORY*	HAZARD*
Great South Pond	Plymouth	P1 (all species), P5	Mercury
Grove Pond (See footnote 2)	Ft. Devens, Ayer	P6	Mercury
Haggetts Pond	Andover	P1 (LMB), P3 (LMB)	Mercury
Hamblin Pond	Barnstable	P1 (SMB), P3 (SMB)	Mercury
Heard Pond	Wayland	P6	Mercury
Hickory Hills Lake	Lunenburg	P1 (all species), P5	Mercury
Hocomonco Pond	Westborough	P6	PAHs
Holland Pond - See Quinebaug River			
Hood's Pond	Topsfield, Ipswich	P1 (all species), P2 (LMB, YP), P4	Mercury
Hoosic River	N. Adams, Williamstown	P6	PCBs
Houey's Pond	Boxford	P1 (all species), P5	Mercury
Housatonic River (See footnote 3)	All towns from Dalton to Sheffield	P6 (also includes frogs and turtles)	PCBs
Ice Pond - See Cochato River			
Indian Head River - See Drinkwater River			
John's Pond	Mashpee	P1 (all species), P2 (SMB), P4	Mercury
Johnsons Pond	Groveland, Boxford	P1 (LMB), P3 (LMB)	Mercury
Kenoza Lake	Haverhill	P6	Mercury
Kingman Pond - See Rumford River			
Konkapot River (See footnote 4)	Sheffield, New Marlborough	P1 (all species), P5	Mercury
Lakes whose names begin with "Lake" are listed under the second word in their name (so that Lake Pentucket is listed under "Pentucket," etc.)			
Lewin Brook Impoundment	Swansea	P1 (BC, LMB), P3 (BC, LMB)	Mercury
Locust Pond	Tyngsborough	P1 (all species), P5	Mercury
Long Pond	Dracut, Tyngsboro	P1 (all species), P5	Mercury

WATER BODY	TOWN(s)	FISH ADVISORY*	HAZARD*
Long Pond (Rochester) - See Snipituit Pond			
Lowe Pond	Boxford	P1 (all species), P2 (LMB), P4	Mercury
Martins Pond	North Reading	P1 (LMB & BC & YP), P3 (LMB & BC& YP)	Mercury
Mashpee/Wakeby Pond	Mashpee, Sandwich	P1 (SMB), P3 (SMB)	Mercury
Massapoag Pond	Dunstable, Groton, Tyngsboro	P1 (all species), P5	Mercury
Merrimack River	All towns between Tyngsborough and Methuen	P1 (WS & LMB), P3 (WS & LMB)	Mercury
Miacomet Pond	Nantucket	P1 (all species), P2 (WP), P4	Mercury
Mill Pond	Burlington	P1 (LMB), P3 (LMB)	Mercury
Mill Pond	Westborough above GH Nichols Dam	P1 (all species), P2 (LMB)	Mercury
Mill River	Hopedale	P1 (all species), P5	PCBs
Millers River (See footnote 5)	All towns from Erving to Winchendon	P1 (all species), P2 (BT & AE), P4	Mercury, PCBs
Millvale Reservoir	Haverhill	P1 (all species), P2 (LMB)	Mercury
Mirror Lake	Ft. Devens, Harvard	P1 (LMB), P3 (LMB)	Mercury
Muddy River	Boston, Brookline	P1 (all species), P2 (BB & C & AE), P4	PCBs
Neponset River between the Hollingsworth & Vose Dam in Walpole and the Tilestone Dam in Boston (Hyde Park)	All towns between Walpole and Boston (Hyde Park)	P1 (BB), P3 (BB)	PCBs
Newfield Pond (= Freeman Lake)	Chelmsford	P1 (LMB), P3 (LMB)	Mercury
Noquochoke Lake	Dartmouth	P1 (all species), P2 (LMB & AE), P4	Mercury, PCBs
Norton Reservoir - See Rumford River			
Nutting Lake	Billerica	P1 (all species), P5	Mercury

WATER BODY	TOWN(s)	FISH ADVISORY*	HAZARD*
Otis Reservoir	Otis, Tolland	P1 (all species), P5	Mercury
Otter River, within 1/2 mile of Millers River	Templeton, Winchendon	P1 (all species), P2 (WS & BB)	PCBs
Pentucket Pond	Georgetown	P1 (all species), P2 (LMB & BC), P4	Mercury
Pentucket, Lake	Haverhill	P6	Mercury
Pepperell Pond	Pepperell, Groton	P1 (all species), P2 (LMB), P4	Mercury
Peters Pond	Sandwich	P1 (SMB), P3 (SMB)	Mercury
Plainfield Pond	Plainfield	P1 (LMB), P3 (LMB)	Mercury
Plowshop Pond (See footnote 6)	Ft. Devens, Ayer	P6	Mercury
Pomps Pond	Andover	P1 (all species), P2 (LMB), P4	Mercury
Pontoosuc Lake	Pittsfield, Lanesborough	P1 (LMB), P3 (LMB)	Mercury
Powder Mill Pond	Barre	P1 (all species), P5	Mercury
Puffer's Pond (See footnote 7)	Ft. Devens Sudbury Training Annex, Maynard	P6	Mercury
Quabbin & Wachusett Reservoirs (See footnote 8)	New Salem, Shutesbury, Petersham, Hardwick, Ware, Pelham, Belchertown, Boylston, West Boylston, Sterling, Clinton	See footnote	Mercury
Quaboag Pond	E. Brookfield, Brookfield	P1 (all species), P2 (LMB), P4	Mercury
Quinebaug River, East Brimfield Reservoir, Holland Pond	Brimfield, Holland	P1 (all species), P5	Mercury
Rice City Pond	Uxbridge, Northbridge	P1 (all species), P2 (C)	PCBs
Riverdale Pond	Northbridge	P1 (all species), P5	PCBs
Rock Pond	Georgetown	P6	Mercury
Rohunta, Lake	Orange, Athol, New Salem	P1 (all species), P5	Mercury
Rumford River from Glue Factory Pond Dam; Fulton, Kingman, & Cabot ponds; Norton reservoir	Foxborough, Mansfield, Norton	P6	Dioxin and pesticides
Saltonstall, Lake	Haverhill	P1 (LMB), P3 (LMB)	Mercury
Shawsheen River - See Ballardvale Impoundment			

WATER BODY	TOWN(s)	FISH ADVISORY*	HAZARD*
Sheep Pond	Brewster	P1 (all species), P5	
Sherman Reservoir	Rowe, Monroe	P1 (all species), P2 (YP), P4	Mercury
Snake Pond	Sandwich	P1 (all species), P2 (SMB), P4	Mercury
Snipituit Pond and Long Pond	Rochester	P1 (BC & LMB), P3 (BC & LMB)	Mercury
Somerset Reservoir	Somerset	P1 (LMB), P3 (LMB)	Mercury
South Pond (= Quacumquasit Pond)	Sturbridge, Brookfield, E. Brookfield	P1 (all species), P5	Mercury
Stevens Pond	North Andover	P1 (LMB), P3 (LMB)	Mercury
Sudbury Reservoir	Marlborough, Southborough	P1 (all species), P2 (Bass)	Mercury
Sudbury River (See footnote 9)	All towns between Ashland and Concord	P6	Mercury
Sylvan Lake - See Cochato River			
Texas Pond(= Thayer Pond)	Oxford	P1 (LMB), P3 (LMB)	Mercury
Thayer Pond – see Texas Pond			
Tom Nevers Pond	Nantucket	P1 (all species), P5	Mercury
Turner Pond	Dartmouth, New Bedford	P1 (all species), P5	Mercury
Upper Naukeag Lake	Ashburnham	P1 (SMB & YP), P3 (SMB & YP)	Mercury
Upper Reservoir	Westminster	P1 (all species), P5	Mercury
Wachusett Reservoir - See Quabbin Reservoir			
Waite Pond	Leicester	P1 (all species), P5	Mercury
Walden Pond	Concord	P1 (LMB & SMB), P3 (LMB & SMB)	Mercury
Wampanoag, Lake	Ashburnam, Gardner	P5	Mercury
Warner's Pond	Concord	P1 (LMB), P3 (LMB)	Mercury
Wequaquet Lake	Barnstable	P1 (LMB), P3 (LMB)	Mercury
Whitehall Reservoir	Hopkinton	P1 (all species), P2 (YB), P4	Mercury

WATER BODY	TOWN(s)	FISH ADVISORY*	HAZARD*
Willet Pond	Walpole, Norwood, Westwood	P1 (LMB), P3 (LMB)	Mercury
Winthrop, Lake	Holliston	P6	Dioxin

* See below for codes.

Advice Codes

P1 (all species)	Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from this water body.
P1 (species)	Children younger than 12 years, pregnant women, and nursing mothers should not eat any of the affected fish species (in parenthesis) from this water body.
P2 (species)	The general public should not consume any of the affected fish species (in parenthesis) from this water body.
P3 (species)	The general public should limit consumption of affected fish species (in parenthesis) to two meals per month.
P4	The general public should limit consumption of non-affected fish from this water body to two meals per month.
P5	The general public should limit consumption of all fish from this water body to two meals per month.
P6	The general public should not consume any fish from this water body.

Fish Codes

AE American Eel	CCS Creek Chubsucker	SMB Smallmouth Bass
B Bluegill	CP Chain Pickerel	WC White Catfish
BB Brown Bullhead	FF Fallfish	WP White Perch
BC Black Crappie	GRS Green Sunfish	WS White Sucker
BT Brown Trout	LMB Largemouth Bass	YB Yellow Bullhead
C Carp	LNS Longnose Sucker	YP Yellow Perch
CB Calico Bass	P Pumpkinseed	
CC Channel Catfish	RT Rainbow Trout	

Hazard Code

PCB=polychlorinated biphenyls
PAHs=polycyclic aromatic hydrocarbons

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[1] Factory Pond Advisory has been updated (October 1995) to include the Drinkwater River/Indian Head River between the Forge Pond and the Luddam's Ford Dam, and includes

Factory Pond.
[2] Municipality issued advisory.
* See page 4 for codes.
[3] Fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking.
[4] The Konkapot River Fish Consumption Advisory pertains from Mill River to the confluence with the Housatonic River.
[5] The public should refrain from eating all brown trout and eels from the Millers River below the confluence with the Otter River. Consumption of all other fish species from the Millers River and its tributaries should be limited to two meals per month per person. Pregnant women, nursing mothers, and children under 12 years of age should not eat any fish from the Millers River and its tributaries in order to prevent exposure to infants and developing fetuses.
[6] U.S. Army issued advisory.
[7] U.S. Army issued advisory.
[8] Children younger than 12 years, pregnant women, and nursing women should not consume fish except for lake trout less than 24 inches long and salmon. All other people should not eat smallmouth bass, largemouth bass, or lake trout greater than 24 inches long; may eat unlimited amounts of salmon and lake trout less than 24 inches long; and should limit consumption of all other Quabbin and Wachusett Reservoir fish species to one five-ounce meal per week.
[9] The Sudbury River Fish Consumption Advisory pertains from Ashland to its confluence with the Assabet and Concord Rivers and includes the Stern and Bracket Reservoirs in Framingham.